

Correlation Between Computed Tomography Severity Score and Mortality in Patients with COVID-19 Chest Infection

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ABSTRACT

Introduction: Computed Tomography (CT) is one of the most essential diagnostic tools for early identification and treatment of COVID -19 pneumonia. The objective of this study was to identify the relationship between CT severity score and mortality in COVID-19 patients.

Method: A total of 62 patients with confirmed COVID-19 were included in this study. All these patients underwent High resolution computed tomography (HRCT) chest using a standard protocol. The CT severity score in all of these patients was calculated and the results were analyzed by SPSS version 21.

Results: A higher CT severity score was associated with higher chances of mortality in the patients of COVID-19. There was no significant association of mortality with the age, sex, and number of lobes involvement

Conclusion: HRCT chest can help in the early identification of the patients who need to be admitted to the Intensive care unit. Early admission and intervention to patients with high CT severity scores can help to reduce mortality.

Keywords: COVID-19; Intensive Care Units; Tomography, X-Ray Computed

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INTRODUCTION

In late December 2019, an outbreak of new coronavirus disease (COVID-19) caused by Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was reported in Wuhan city, China.¹ The disease rapidly crossed the international borders spreading all around the globe. On March 11, 2020,



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the World Health Organization (WHO) declared the novel coronavirus outbreak to be a pandemic.² In Nepal, the first case of COVID-19 was reported on 23rd January 2020.³ The first wave was subsequently followed by second and third waves in various parts of the world. In Nepal currently, we are entering the third wave.

Several studies have reported the Computed Tomography (CT) findings of COVID-19 Pneumonia.⁴⁻⁶ However, the outcome of patients has not been definite in many of these series. Therefore, the estimation of risk factors for severe disease and death in these earlier studies is not very strong, and there are limited data available about the prognostic application of CT chest.

This study aimed to describe the relationship between chest CT severity score and COVID-19 mortality.

METHODS

It was a cross-sectional observational study conducted in the Department of Radiology of Manipal teaching hospital, Pokhara. The study was conducted over one and half months from 17th May 2021 to 5th July 2021. Informed consent was taken from the patients prior to their enrollment into the study. Ethical clearance was obtained before the study from the institutional review board of Manipal Teaching Hospital.

All the Reverse transcription-polymerase chain reaction (RT-PCR) positive COVID-19 patients with chest symptoms of age ≥ 18 years sent to the radiology department for High-resolution CT (HRCT) Chest were included in the study.

All patients underwent CT chest in Manipal teaching hospital using 128 slice CT (PHILIPS). CT scan was done using standard protocol to minimize radiation dose to the patient. Axial sections with 3 mm slice thickness and FOV of 400 mm were obtained. Tube current of 20–30 mA, tube voltage of 120–140 kV, matrix of 512, pitch 1.078, and rotation time of 0.75 s were used.

Sagittal and coronal reformatted images were subsequently obtained. No contrast material was used. Standard safety precautions as implemented by WHO were followed.

All CT scan images were analyzed and reviewed by a radiologist. The severity score was calculated based on lung involvement percentage for each patient by scoring the percentage of each lobe involvement individually and was given a score from 1 to 5 were;

Score 1 represented < 5% involvement

Score 2: 5–25% involvement

Score 3: 26–50% involvement

Score 4: 51–75% involvement

Score 5: > 75% involvement.

Then, the final score was the sum of individual lobar scores and was out of 25 (total score); the total lung involvement was then obtained by multiplying the total score by four.⁷

Data regarding age, sex, mean CT severity score, mean percentage of lung involvement, and the number of lobes involved were recorded in the performed performa. The collected data were tabulated and entered in an MS excel sheet. Analysis was done by using SPSS 21.0. A logistic regression test was performed to ascertain the effects of age, sex, CT score, Percentage of lung involvement, and several lobes involved on the likelihood of mortality of COVID-19 patients. Statistically significant results were considered at a p value of < 0.05.

RESULTS

A total of 62 patients with laboratory-confirmed COVID-19 infection were included in our study. Overall, the mean age was 57.2 ± 15.9 years with an age range of 20 to 90 years. A clear male preponderance (61.3%) was noted with a male: female ratio of 1.5:1. Of the 62 patients, 38(61.3%) patients recovered from COVID-19 whereas 24(38.9%) died in the hospital (Table 1). Out of 38 patients who survived, 21(55.3%) were male and 17(44.7%) were female. Similarly, out of 24 who died in hospital, 17 (70.8%)

were males and 7(29.2%) were females. The Mean age of the patient who survived was 54.2 ± 13.3 years compared to the mean age group of patients who died which was 62.0 ± 18.5 years (Table 2).

Table 1: Outcome of treatment of COVID-19 patients

	Frequency	Percentage
Recovered	38	61.3
Diseased	24	38.7
Total	62	100

Increasing CT score and percentage of lung involvement were significantly associated

with an increased likelihood of mortality of patients. There was no significant association of mortality with age, sex, and several lobes' involvement as shown in table 2. Furthermore, this study showed that the left upper lobe was the least affected lobe with a mean CT score of 2.87 and the left lower lobe was the severely affected lobe in the COVID-19 patients with the mean score of 3.40 as shown in table 3. All the patients who died of COVID -19 infection had all five lobes involved (Table 4). Most of the patients who died had severe disease with a CT severity score of more than 17. Among the patients who recovered, 63.2% had moderate disease with CT severity score of 8 to 17 (Table 5).

Table 2: Demographic and radiological data of COVID-19 patients

Variables	Recovered	Deceased	p-value
Mean age	54.2 ± 13.3	62.0 ± 18.5	0.06
Sex			0.07
Male	21	17	
Female	17	7	
Mean CT severity score	14.0 ± 4.9	18 ± 3.8	0.04
Mean percentage of lung involvement	56.1 ± 14.0	72 ± 15.3	0.04
Number of lobes involved			0.09
1 lobe	0	0	
2lobes	0	0	
3 lobes	1	0	
4 lobes	2	0	
5 lobes	35	24	

Table 3: Lobar involvement in COVID-19

	RUL	RML	RLL	LUL	LLL
Mean CT severity score \pm SD	3.0 ± 1.1	2.7 ± 1.2	3.5 ± 1.1	2.8 ± 1.1	3.4 ± 1.0

RUL: Right upper lobe

RML: Right middle lobe

RLL: Right lower lobe

LUL: Left upper lobe

LLL: Left lower lobe

SD: standard deviation

Table 4: Comparison of the number of lobes involved with the outcome of treatment

Outcome of treatment	Frequency	Percentage
Recovered		
3 lobes involved	1	2.6
4 lobes involved	2	5.3
5 lobes involved	35	92.1
Death		
5 lobes involved	24	100

Table 5: Comparison of CT Severity Score with outcome of treatment

Outcome of treatment	Frequency	Percentage
Recovered		
Mild (7 or less)	5	13.2
Moderate (8-17)	24	63.2
Severe (>17)	9	23.7
Total	38	100
Death		
Moderate (8-17)	11	45.8
Severe (>17)	13	54.2
Total	24	100.0

DISCUSSION

With the spread of the Novel coronavirus, it has been a growing concern for scientists all around the world. The pathogenesis of COVID-19 is still a mystery. However, diffuse alveolar damage and progressive respiratory failure is the major cause of death in these patients.⁸ The predominant finding in HRCT of COVID-19 Patients includes multiple ground-glass opacities and/or consolidations.⁹ In this study, we have analyzed the high-resolution Computerized tomography scan of the chest in patients with COVID-19 infection. There were 62 patients with laboratory-confirmed COVID-19 pneumonia. All patients were treated at Manipal Teaching Hospital Pokhara.

We have found that among the patients of COVID-19 who died, the CT severity score was moderate to severe in 100% of cases. About 54% of total deaths of COVID-19 patients had CT scores in the severe category whereas about 46% were in the moderate CT severity category.

Among those COVID-19 patients who survived, 63.2% of the patients had moderate CT severity category and 23.7% had severe CT category. The results of our study show that mortality was significantly higher in patients with higher CT severity scores. A similar study was done by Tabatabaei SM et al where they found that CT severity score as a reliable index to predict the mortality in the patients of COVID-19.¹⁰ Furthermore, in the study done by Homayounieh F et al, they too found that higher CT severity score in COVID-19 patients was associated with increased mortality as in our study.¹¹ Similarly, in a study done in China by Yuan M et al in 2019, they found that the median CT score of the mortality group was higher compared to the survival group.¹² Feng Z et al found CT severity score as an independent factor for progression in COVID-19 pneumonia patients as in our study.¹³

In severe illness, there is direct damage to the lungs by the virus, causing inflammatory changes in the alveolar walls, limiting oxygen

exchange, leading to acute respiratory distress, pulmonary fibrosis, and ultimately death. In addition, autopsy of patients who died of COVID-19 disease also detected a significant pulmonary thromboembolizing effect.¹⁴⁻¹⁶

The results of our study show that mortality was significantly higher in patients with higher CT severity scores. Thus, patients with higher CT severity scores could benefit from early intensive care and treatment.

HRCT chest can be of prognostic significance in COVID-19 patients and help as an adjunct tool to patient prognostication.

CONCLUSION

In patients of COVID-19, a higher CT severity score was associated with increased chances of mortality. Hence, HRCT chest can be of prognostic use in COVID-19 patients and help in early admission of COVID-19 patients preventing mortality.

CONFLICT OF INTEREST

None

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